REMARKS

Applicants respectfully request reconsideration of the above-identified application in view of the amendment above and the remarks below.

Claims 9, 30-57 and 62-70 have been canceled in this paper. Claims 1, 10-12, 16-18, 21, 23, 27, 29 and 58 have been amended in this paper. Claims 71-78 have been added in this paper. Therefore, claims 1-8, 10-29, 58-61 and 71-78 are pending and are under active consideration.

Claims 1-8, 21-26, 58-61 and 65-66 stand rejected under 35 U.S.C. 102(e) "as being anticipated by Mickols (US 6,280,853 B1)." In support of the rejection, the Patent Office states the following:

> Claims 1 and 58: Mickols teaches a reverse osmosis membrane comprising a microporous support, a polyamide layer on the microporous support (col 3 lines 10-20) and a hydrophilic coating of a crosslinked epoxy compound (col 4 lines 25-46) as in claim 1. Re claim 58, Mickols teaches a microporous membrane with a hydrophilic coating, as above (claim open-ended).
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> Claims 2 and 59: microporous support is polysulfone, etc. (col 6 line 5).
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> Claim 3: polyamide layer by interfacial polymerization (col 3 lines 10-28).
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> Claims 4-6: polyfunctional amine is an aromatic primary amine, and metaphenylene diamine or piperazine (col 3 lines).
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> Claims 7-8: polyfunctional acyl halide (col 3 lines 10-28); trimesoyl chloride (col 3 line 55).
>
> Claims 21, 22 and 65: polyfunctional epoxy has exactly two epoxy groups (examples, col 4 lines 27-45); ethylene glycol diglycidyl ether (example).

Claims 23, 24, 66: cross-linking compound has at least three epoxy-reacting groups; such as amine, or carbonyl (claims 13 and 16; col 4 lines 15-59, especially 37-46; col 5 lines 10-62).

Claims 25, 26: three epoxy reactive groups the same - the polyamide layer; or different (col 4 lines 15-59, col 5 lines 10-63).

Claims 60 and 61: microporous support is a microfiltration or ultrafiltration membrane: see col 6 lines 1-15; col 1 lines 16-30.

Insofar as the foregoing rejection pertains to claims 65-66, the foregoing rejection is moot in view of Applicants' cancellation herein of claims 65-66. Insofar as the foregoing rejection pertains to claims 1-8, 21-26, 58-61, Applicants respectfully traverse the foregoing rejection.

Claim 1, from which claims 2-8 depend, has been amended herein and now recites "[a] composite polyamide reverse osmosis membrane comprising:

(a) a microporous support;

(b) a polyamide layer on said microporous support; and

(c) a hydrophilic coating on said polyamide layer, said hydrophilic coating being made by (i) applying to the polyamide layer a quantity of a polyfunctional epoxy compound, said polyfunctional epoxy compound comprising at least three epoxy groups, and (ii) then, cross-linking the polyfunctional epoxy compound in such a manner as to yield a water-insoluble polymer, wherein said polyfunctional epoxy compound is cross-linked through at least one of self-polymerization and the help of a cross-linking compound, said cross-linking compound differing from said polyamide layer."

Claim 1 is neither anticipated by nor rendered obvious over Mickols for at least the reason that Mickols does not teach or suggest a composite polyamide reverse osmosis membrane comprising, among other things, a hydrophilic coating on the polyamide layer, wherein said

hydrophilic coating is made by (i) applying to the polyamide layer a quantity of a polyfunctional epoxy compound, said polyfunctional epoxy compound comprising at least three epoxy groups, and (ii) then, cross-linking the polyfunctional epoxy compound in such a manner as to yield a water-insoluble polymer, wherein said polyfunctional epoxy compound is cross-linked through at least one of **self-polymerization** and the **help of a cross-linking compound, said cross-linking compound differing from said polyamide layer**.

Instead, Mickols discloses a composite polyamide membrane in which polyalkylene oxide compounds are **covalently bonded directly to functional groups of the polyamide layer**. The Mickols membrane also differs from the claimed membrane in that the Mickols membrane does not include (i) polyfunctional epoxy compounds having **at least three** epoxy groups and (ii) polyfunctional epoxy groups that are cross-linked to one another by **self-polymerization** and/or by the help of a **cross-linking compound other than the polyamide layer**.

It may be noted that, because the polyalkylene oxide compounds of Mickols are grafted onto the polyamide layer solely by virtue of covalently bonding between said polyalkylene oxide compounds and exposed functional groups of the polyamide layer, the quantity of polyalkylene oxide compound that can be bonded to the polyamide layer is dependent upon the quantity of functional groups in the polyamide layer that are available for bonding. Such a quantity of functional groups available for bonding is typically relatively small. By contrast, the claimed membrane does not require any bonding between the polyfunctional epoxy compounds applied to the polyamide membrane and the polyamide membrane. Instead, the polyfunctional epoxy compounds are cross-linked to one another, by self-polymerization and/or by a cross-linking compound other than the polyamide layer.

Claim 21, from which claims 22-26 depend, has been amended herein and now recites "[a] composite polyamide reverse osmosis membrane comprising:

(a) a microporous support;

(b) a polyamide layer on said microporous support; and

(c) a hydrophilic coating on said polyamide layer, said hydrophilic coating being made by (i) applying to the polyamide layer a quantity of a polyfunctional epoxy compound, said polyfunctional epoxy compound comprising exactly two epoxy groups, and (ii) then, cross-linking the polyfunctional epoxy compound in such a manner as to yield a water-insoluble polymer, wherein said polyfunctional epoxy compound is cross-linked through the help of a cross-linking compound, said cross-linking compound differing from said polyamide layer."

Claim 21 is neither anticipated by nor rendered obvious over Mickols for at least the reason that Mickols does not teach or suggest a composite polyamide reverse osmosis membrane comprising, among other things, a hydrophilic coating on the polyamide layer, wherein said hydrophilic coating is made by (i) applying to the polyamide layer a quantity of a polyfunctional epoxy compound, said polyfunctional epoxy compound comprising exactly two epoxy groups, and (ii) then, cross-linking the polyfunctional epoxy compound in such a manner as to yield a water-insoluble polymer, wherein said polyfunctional epoxy compound is cross-linked through the help of a cross-linking compound, said cross-linking compound **differing** from said polyamide layer.

Instead, as noted above, the polyalkylene oxide compound of Mickols is bonded only to the polyamide layer. Consequently, said polyalkylene oxide compound of Mickols cannot be said to be cross-linked through the help of a cross-linking compound other than the polyamide layer.

Claim 58, from which claims 59-61 depend, has been amended herein and now recites, "[a] microporous membrane comprising:

(a) a microporous support; and

(b) a hydrophilic coating directly on said microporous support, said hydrophilic coating being made by (i) applying to the microporous support a quantity of a polyfunctional epoxy compound, said polyfunctional epoxy compound comprising at least three epoxy groups, and (ii) then, cross-linking the polyfunctional epoxy compound in such a manner as to yield a water-insoluble polymer, wherein said polyfunctional epoxy compound is cross-linked through self-polymerization."

Claim 58 is neither anticipated by nor rendered obvious over Mickols for at least the reason that Mickols does not teach or suggest a microporous membrane comprising, among other things, a hydrophilic coating **directly** on said microporous support, said hydrophilic coating being made by (i) applying to the microporous support a quantity of a polyfunctional epoxy compound, said polyfunctional epoxy compound comprising at least three epoxy groups, and (ii) then, cross-linking the polyfunctional epoxy compound in such a manner as to yield a water-insoluble polymer, wherein said polyfunctional epoxy compound is cross-linked through self-polymerization.

Instead, as noted above, Mickols discloses a composite polyamide membrane in which polyalkylene oxide compounds are covalently bonded to a polyamide layer. Consequently, because Mickols includes an intervening polyamide layer located between the microporous support and the polyalkylene oxide compounds, Mickols differs from the claimed membrane in that Mickols does not include a hydrophilic coating of the type claimed applied **directly** to the microporous support. (In fact, because the polyalkylene oxide compounds of Mickols are covalently bonded to functional

groups in the polyamide layer, there would have been no reason for one ordinary skill in the art to have modified Mickols to remove the polyamide layer since the microporous support has substantially fewer functional groups for bonding the polyalkylene oxide compounds.) Mickols also differs from the claimed membrane in that Mickols does not involve the use of a polyfunctional epoxy compound comprising at least three epoxy groups and does not involve self-polymerization of the polyfunctional epoxy compounds.

Accordingly, for at least the above reasons, the foregoing rejection should be withdrawn.

Claims 9-15, 17-20, 27-28, 30, 62-64 and 67 stand rejected under 35 U.S.C. 103(a) "as being unpatentable over Mickols (853) in view of Marinaccio et al (US 4,915,839)." In support of the rejection, the Patent Office states the following:

> Mickols teaches all the limitations of claims 1, 21, 23, 58 and 65. Instant claims add further limitations not taught by Mickols, but taught by Marinaccio, as follows:
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> Claims 9 and 62: polyfunctional epoxy has at least three epoxy groups: see structures of col 12.
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> Claim 10: one or more of the compounds listed are taught by Marinaccio (col 14 lines 1-68).
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> Claims 11 and 63: cross-linked through self polymerization: inherent from Mickols in view of Marinaccio; similar reagents as used by the applicant should produce similar products. The express, implicit, and inherent disclosures of a prior art reference may be relied upon in the rejection of claims under 35 U.S.C. 102 or 103. "The inherent teaching of a prior art reference, a question of fact, arises both in the context of anticipation and obviousness." (Citations omitted.)
>
> Claims 12 and 64: cross-linking with the help of a cross-linking compound - see col 9 line 61 - col 14 line 10).

Claim 13: epoxy reactive groups amino or carboxyl - col 12 line 32 - col 13 line 66.

Claim 14: at least two epoxy reactive groups are the same - carboxylic, for example - col 13 line 56-62.

Claim 15: epoxy reactive groups can be different: amine or carboxyl groups from the polyamide layer (Mickols col 4 lines 55-58) and carboxyl or amine groups as used by Marinaccio (col 12 and 13).

Claim 17: alkane diamine as per the formula - see col 11 line 30; col 12 lines 50-60.

Claims 18 and 27: cross-linking agent as diethylene triamine, etc - col 11 lines 20-30.

Claims 19, 20 and 28: Marinaccio may not be listing the exact carboxylic or sulfonic acids listed as in these claims, but teaches polyfunctional carboxylic or sulfonic acids in col 13 line 55 - col 14 line 11, which would afford anionic (negative charged) membrane, or compounds having zwitter ions in col 14 lines 55-68, as recited in the specification page 19, 4th para 4 and page 20, 1st para, and therefore, equivalent. In this case, the prior art element: (A) performs the identical function specified in the claim in substantially the same way, and produces substantially the same results as the corresponding element disclosed in the specification. Kemco Sales, Inc. v. Control Papers Co., 208 F.3d 1352, 54 USPQ2d 1308 (Fed. Cir. 2000). (B) is not excluded by any explicit definition provided in the specification for an equivalent. A person of ordinary skill in the art would have recognized the interchangeability of the element shown in the prior art for the corresponding element disclosed in the specification. (Citations omitted.) Also, a prima facie case of obviousness may be made when chemical compounds have very close structural similarities and similar utilities. "An obviousness rejection based on similarity in chemical structure and function entails the motivation of one skilled in the art to make a claimed compound, in the expectation that compounds similar in structure will have similar properties." (Citations omitted.)

Claims 30 and 67: crosslinking compound having two primary amino groups, etc - see table in col 12 at line 51.

It would be obvious to one of ordinary skill in the art at the time of invention to use the teaching of Marinaccio in the teaching of

> Mickols for having cationic, anionic or zwitterion membranes because it makes the membrane sanitizable or sterilizable, and capable of capturing anionic, cationic and other particles smaller than the effective pore size of the membrane (Marinaccio col 5 line 55 - col 6 line 11).

Insofar as the foregoing rejection pertains to claims 9, 30, 62-64 and 67, the rejection is moot in view of the cancellation herein of claims 9, 30, 62-64 and 67. Insofar as the foregoing rejection pertains to claims 10-15, 17-20, and 27-28, Applicants respectfully traverse the foregoing rejection.

Claims 10-15 and 17-20 depend from claim 1. Claim 1 is patentable over Mickols for at least the reasons given above. Marinaccio et al. fails to cure all of the deficiencies of Mickols for at least the following reasons: First, the Patent Office is apparently contending that, because Marinaccio et al. allegedly teaches polyfunctional epoxy compounds having at least three epoxy groups, it would have been obvious to replace the polyfunctional epoxy compounds of Mickols with the polyfunctional epoxy compounds of Marinaccio et al.. Applicants respectfully disagree. The polyfunctional epoxy compounds of Mickols are being used in an **entirely different manner** and for an **entirely different purpose** than are the polyfunctional epoxy compounds of Marinaccio et al.. More specifically, the polyfunctional epoxy compounds of Mickols are **covalently bonded directly to a polyamide layer** of a composite polyamide reverse osmosis membrane for the alleged purpose of **improving the fouling resistance** of the membrane. By contrast, the membrane of Marinaccio et al. does not even include a polyamide layer, the polyfunctional epoxy compounds instead being coated **directly onto the microporous support** in order to improve, among other things, the **filtering capacity** of the membrane - not to affect the fouling resistance of the membrane. (As can readily be appreciated, because the membrane of Marinaccio et al. does not include a polyamide layer, there is a great need to improve the filtering capacity of the membrane if the

membrane is to be used for the types of applications aspired to by Marinaccio et al.. Such a need, however, is greatly diminished in the case of Mickols, which already includes a polyamide layer.) Moreover, it should be noted that, if one were to coat the Marinaccio polymers onto a polyamide reverse osmosis membrane as disclosed in Mickols, there would be a substantial loss in salt rejection and flux in the membrane, a fact that further would have led one of ordinary skill in the art not to make the modification proposed by the Patent Office. Consequently, in view of the fact that the polyfunctional epoxy compounds of Marinaccio et al. are being used for a different purpose and in a different manner than the polyfunctional epoxy compounds of Mickols, one of ordinary skill in the art would not have been motivated to replace one with the other.

Claims 27 and 28 depend from claim 21. Claim 21 is patentable over Mickols for at least the reasons given above. Marinaccio et al. fails to cure all of the deficiencies of Mickols for at least the following reasons: First, the Patent Office is apparently contending that, because Marinaccio et al. allegedly teaches cross-linking polyfunctional epoxy compounds having two epoxy groups, it would have been obvious to cross-link the polyfunctional epoxy compounds of Mickols in a similar manner to that taught in Marinaccio et al.. Applicants respectfully disagree. As noted above, the polyalkylene oxide compounds of Mickols are used in an entirely different manner and for an entirely different purpose than are the polyfunctional epoxy compounds of Marinaccio et al.. In fact, as noted above, because the polyalkylene oxide compounds of Mickols are bonded to the functional groups of the polyamide layer, which are few and far between, there is not uniform coverage of the polyamide layer with the grafted compound. Consequently, one could not assume that it would necessarily be possible to be able to cross-link the grafted compounds.

Accordingly, for at least the above reasons, the foregoing rejection should be withdrawn.

Claim 16 stands rejected under 35 U.S.C. 103(a) "as being unpatentable over Mickols (853) in view of Marinaccio et al (US 4,915,839) as in claim 13 above and further in view of Linder (US 4,778,596)." In support of the rejection, the Patent Office states the following:

> Mickols in view of Marinaccio does not teach using a polyol as crosslinking compound. Linder teaches coating a semipermeable membrane with a hydrophilic coating comprising an epoxy compound and a polyol such as PVA (col 4 lines 50-68; col 5 lines 1-35; col 7 lines 5-40 and 45-50; col 9 line 43-55; col 10 lines 63-68). It would be obvious to one of ordinary skill in the art at the time of invention to use the teaching of Linder in the teaching of Mickols in view of Marinaccio for making a hydrophilic cross-linked reverse osmosis membrane with improved solvent, pressure and temperature resistance (see abstract).

Applicants respectfully traverse the foregoing rejection. Claim 16 depends from claim 13. Claim 13 is patentable over Mickols in view of Marinaccio et al. for at least the reasons given above. Linder does not cure all of the deficiencies of Mickols and Marinaccio et al. as Linder, like Marinaccio et al., relates to a membrane that does not include a polyamide layer and involves the use of a polymer coating that would adversely affect the salt rejection and flux of a polyamide reverse osmosis membrane. Consequently, one of ordinary skill in the art would not have been motivated to combine Linder with Mickols and Marinaccio et al. in the manner proposed by the Patent Office. Therefore, based at least on its dependency from claim 13, claim 16 is patentable over the applied combination of references.

Accordingly, for at least the above reasons, the foregoing rejection should be withdrawn.

Claim 29 stands rejected under 35 U.S.C. 103(a) "as being unpatentable over Mickols (853) in view of Linder (US 4,778,596)." In support of the foregoing rejection, the Patent Office states the following:

> Mickols teaches all the limitations of claim 23. Claim 29 adds further limitation of polyols as cross-linking compounds. Linder teaches coating a semipermeable membrane with a hydrophilic coating comprising an epoxy compound and a polyol such as PVA (col 4 lines 50-68; col 5 lines 1-35; col 7 lines 5-40 and 45-50; col 9 line 43-55; col 10 lines 63-68). It would be obvious to one of ordinary skill in the art at the time of invention to use the teaching of Linder in the teaching of Mickols for making a hydrophilic cross-linked reverse osmosis membrane with improved solvent, pressure and temperature resistance (see abstract).

Applicants respectfully traverse the foregoing rejection. Claim 29 depends from claim 23. Claim 23 is patentable over Mickols for at least the reasons given above. Linder, which relates to a coated membrane that does not include a polyamide layer and whose polyfunctional epoxy compounds are used in an entirely different manner and for an entirely different purpose than the polyalkylene oxide compounds of Mickols, fails to cure all of the deficiencies of Mickols. For example, the Patent Office has failed to explain why a person of ordinary skill in the art would have been motivated to cross-link the grafted compounds of Mickols.

Accordingly, for at least the foregoing reasons, the foregoing rejection should be withdrawn.

New claims 71-72 depend from claim 1 and are patentable based at least on their respective dependencies. New claims 73-75 depend from claim 58 and are patentable based at least on their respective dependencies. New claims 76-78 are patentable for at least the reason that the references do not teach or suggest a microporous membrane comprising a microporous support and a neutrally-charged, hydrophilic coating of the type recited that is coated directly onto said microporous support.

In conclusion, it is respectfully submitted that the present application is in condition for allowance. Prompt and favorable action is earnestly solicited.

If there are any fees due in connection with the filing of this paper that are not accounted for, the Examiner is authorized to charge the fees to our Deposit Account No. 11-1755. If a fee is required for an extension of time under 37 C.F.R. 1.136 that is not accounted for already, such an extension of time is requested and the fee should also be charged to our Deposit Account.

Respectfully submitted,

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I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Mail Stop Non-Fee Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on March 19, 2004.

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